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National Occupational Analysis

2011 | Construction Electrician

Human Resources and Skills Development Canada
Ressources humaines et Développement des compétences Canada
Canada

Occupational Analyses Series

Construction Electrician

2011

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FOREWORD

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis as the national standard for the occupation of Construction Electrician.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada (HRSDC) sponsors a program, under the guidance of the CCDA, to develop a series of National Occupational Analyses (NOAs).

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

ACKNOWLEDGEMENTS

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This analysis was prepared by the Workplace Partnerships Directorate of HRSDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the NOA development team of the Trades and Apprenticeship Division. Jacques Austin for the host jurisdiction of Saskatchewan also participated in the development of this NOA.

TABLE OF CONTENTS

FOREWORD			I
ACKNOWLEDGEMENTS			II
TABLE OF CONTENTS			III
LIST OF PUBLISHED NATIONAL OCCUPATIONAL ANALYSES			V
STRUCTURE OF ANALYSIS			VII
DEVELOPMENT AND VALIDATION OF ANALYSIS			IX
ANALYSIS			
SAFETY			3
SCOPE OF THE CONSTRUCTION ELECTRICIAN TRADE			4
OCCUPATIONAL OBSERVATIONS			6
ESSENTIAL SKILLS SUMMARY			7
BLOCK A	**COMMON OCCUPATIONAL SKILLS**		
	Task 1	Performs safety-related functions.	10
	Task 2	Uses and maintains tools and equipment.	13
	Task 3	Organizes work.	15
	Task 4	Fabricates and installs support components.	19
	Task 5	Commissions and decommissions electrical systems.	21
BLOCK B	**SYSTEMS, DISTRIBUTION AND SERVICES**		
	Task 6	Installs service entrance and distribution equipment.	23
	Task 7	Installs bonding, grounding and cathodic protection systems.	30
	Task 8	Installs power generation systems.	33

	Task 9	Installs high voltage systems.	34
	Task 10	Installs transformers.	37
BLOCK C	**WIRING METHODS**		
	Task 11	Installs raceways and cables.	40
	Task 12	Installs branch circuitry.	44
	Task 13	Installs heating, ventilation and cooling (HVAC) systems.	47
	Task 14	Installs emergency lighting systems.	49
BLOCK D	**MOTORS AND CONTROL SYSTEMS**		
	Task 15	Installs motor controls and protection.	51
	Task 16	Installs motors.	54
BLOCK E	**SIGNALLING AND COMMUNICATION SYSTEMS**		
	Task 17	Installs signalling systems.	57
	Task 18	Installs communication systems.	59
	Task 19	Installs integrated control systems.	61
BLOCK F	**UPGRADING, SERVICE AND MAINTENANCE**		
	Task 20	Upgrades electrical systems.	64
	Task 21	Services electrical systems.	66
	Task 22	Maintains electrical systems.	67

APPENDICES

APPENDIX A	**TOOLS AND EQUIPMENT**	73
APPENDIX B	**GLOSSARY**	76
APPENDIX C	**ACRONYMS**	78
APPENDIX D	**BLOCK AND TASK WEIGHTING**	80
APPENDIX E	**PIE CHART**	84
APPENDIX F	**TASK PROFILE CHART**	85

LIST OF PUBLISHED NATIONAL OCCUPATIONAL ANALYSES (Red Seal Trades)

TITLE	NOC* Code
Agricultural Equipment Technician (2007)	7312
Appliance Service Technician (2011)	7332
Automotive Painter (2009)	7322
Automotive Service Technician (2009)	7321
Baker (2006)	6252
Boilermaker (2008)	7262
Bricklayer (2007)	7281
Cabinetmaker (2007)	7272
Carpenter (2010)	7271
Concrete Finisher (2006)	7282
Construction Craft Worker (2009)	7611
Construction Electrician (2011)	7241
Cook (2008)	6242
Electrical Rewind Mechanic (1999)	7333
Floorcovering Installer (2005)	7295
Glazier (2008)	7292
Hairstylist (2009)	6271
Heavy Duty Equipment Technician (2009)	7312
Industrial Electrician (2011)	7242
Industrial Mechanic (Millwright) (2009)	7311
Instrumentation and Control Technician (2010)	2243
Insulator (Heat and Frost) (2007)	7293
Ironworker (Generalist) (2010)	7264
Ironworker (Reinforcing) (2010)	7264
Ironworker (Structural/Ornamental) (2010)	7264
Landscape Horticulturist (2010)	2225
Lather (Interior Systems Mechanic) (2007)	7284

* National Occupational Classification

TITLE	NOC* Code
Machinist (2010)	7231
Metal Fabricator (Fitter) (2008)	7263
Mobile Crane Operator (2009)	7371
Motorcycle Mechanic (2006)	7334
Motor Vehicle Body Repairer (Metal and Paint) (2010)	7322
Oil Heat Systems Technician (2006)	7331
Painter and Decorator (2007)	7294
Partsperson (2010)	1472
Plumber (2010)	7251
Powerline Technician (2009)	7244
Recreation Vehicle Service Technician (2006)	7383
Refrigeration and Air Conditioning Mechanic (2009)	7313
Rig Technician (2008)	8232
Roofer (2006)	7291
Sheet Metal Worker (2010)	7261
Sprinkler System Installer (2009)	7252
Steamfitter/Pipefitter (2010)	7252
Tilesetter (2010)	7283
Tool and Die Maker (2010)	7232
Transport Trailer Technician (2008)	7321
Truck and Transport Mechanic (2010)	7321
Welder (2009)	7265

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These publications can be ordered or downloaded online at: www.red-seal.ca.

STRUCTURE OF ANALYSIS

To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	the largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Key Competencies	activities that a person should be able to do in order to be called 'competent' in the trade

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Related Components	a list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A
Context	information to clarify the intent and meaning of tasks
Required Knowledge	the elements of knowledge that an individual must acquire to adequately perform a task

The appendices located at the end of the analysis are described as follows:

Appendix A — Tools and Equipment	a non-exhaustive list of tools and equipment used in this trade
Appendix B — Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C — Acronyms	a list of acronyms used in the analysis with their full name
Appendix D — Block and Task Weighting	the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E — Pie Chart	a graph which depicts the national percentages of exam questions assigned to blocks
Appendix F — Task Profile Chart	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

DEVELOPMENT AND VALIDATION OF ANALYSIS

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from HRSDC. This draft analysis breaks down all the tasks performed in the occupation and describes the required knowledge and key competencies required for a tradesperson to demonstrate competence in the trade.

Draft Review

The National Occupational Analysis (NOA) development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

BLOCKS	Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
TASKS	Each jurisdiction assigns a percentage of exam questions to each task within a block.
SUB-TASKS	Each jurisdiction indicates, with a YES or a NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis Not Validated by a province/territory
ND	trade Not Designated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
NATIONAL AVERAGE %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

ANALYSIS

SAFETY

Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties are aware of circumstances and conditions that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

SCOPE OF THE CONSTRUCTION ELECTRICIAN TRADE

"Construction Electrician" is this trade's official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by a construction electrician whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Construction Electrician	✓	✓	✓	✓			✓					✓	
Electrician								✓	✓	✓			✓
Electrician (Construction)					✓						✓		
Electrician Construction and Maintenance						✓							

Construction electricians plan, assemble, install, alter, repair, inspect, verify, commission, operate and maintain electrical systems. Electrical systems provide heating, lighting, power, security, communication and control in residential, commercial, institutional, industrial and entertainment environments. Construction electricians may be self-employed or employed by electrical contractors, utilities, operations and maintenance departments of various facilities.

Construction electricians must read and interpret electrical, mechanical, civil and architectural drawings and specifications such as electrical, building, fire and jurisdictional codes to complete electrical installations. They use electrical test equipment to ensure system safety, functionality and compatibility.

Construction electricians require good communication skills to negotiate, coordinate and facilitate work with customers, co-workers, jurisdictional authorities and other trades. Organizational skills are required to successfully plan and execute their work. They also require strong analytical and problem-solving skills in order to read and interpret diagrams, drawings and specifications. They require mechanical aptitude to install, diagnose and repair systems and components. It is beneficial for construction electricians to have good vision, the ability to distinguish colours, manual dexterity and a willingness to keep up with new developments in the trade.

Their work may be performed indoors or outdoors, at heights, in confined spaces and in hazardous environments. They require stamina as construction electricians spend much of their time performing static and physical tasks. Occupational risks include shocks, industrial diseases, arc flashes, falls and injury from repetitive motion, lifting and kneeling.

This analysis recognizes similarities or overlaps with the work of industrial electricians, powerline technicians, instrumentation and control technicians, and refrigeration and air conditioning mechanics. Construction electricians work with a wide variety of construction tradespeople, engineers and inspectors.

With experience, construction electricians may act as mentors and trainers to apprentices in the trade. They may also advance to positions such as foremen, instructors, project managers, superintendents, estimators, electrical inspectors or start their own contracting business. Construction electricians may enhance their skills in different fields such as restorative, service or retrofit work rather than new construction.

OCCUPATIONAL OBSERVATIONS

The industry is moving toward energy saving, efficient and environmentally friendly construction techniques and devices such as alternative power and light emitting diode (LED) lighting.

Safety standards are becoming more emphasized and recognized in all aspects of the trade. Safety training is branching out to include new areas such as arc flash, safety excellence, high voltage and supervision. There is an understanding that electricians have the responsibility to use their expertise on the worksite to assess risks, manage hazards and report issues as they arise.

More than ever, construction electricians need to constantly upgrade their skills either through formal training, manufacturer's training or on the job training to stay current with new technologies such as programming logic control, solar power systems, wind power systems, smart buildings and Leadership in Energy and Environmental Design (LEED).

Communication systems such as voice, data, audio, video and signalling are constantly evolving requiring construction electricians to expand and upgrade their knowledge and abilities in fibre optics, satellite integration, and wireless and local area networks.

It's becoming cost effective to replace rather than repair electronic parts. The part is either disposed of or repaired by the manufacturer. However, a greater knowledge of electronic systems is required to work with more complex electrical control systems such as solid-state or computer-controlled.

Construction electricians are starting to use three dimensional (3D) modelling to facilitate construction methods such as interpreting and updating drawings. They are using mobile devices to receive specifications and other information and assist in diagnostic procedures.

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.hrsdc.gc.ca/essentialskills

The essential skills profile for the construction electrician trade indicates that the most important essential skills are **reading, numeracy** and **thinking skills** such as **problem solving.**

The application of these skills may be described throughout this document within the competency statements which support each sub-task of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

Reading
Construction electricians read several types of documents such as purchase order agreements and instructions for installing systems and components. They also need to read and understand the Canadian Electrical Code (CEC), which contains legal and highly technical language. They also read other tradespersons' plans and specifications to understand the sequences of installation and locations of apparatus.

Document Use
Construction electricians apply document use skills when they read, interpret and collate information from several documents such as plans, specifications, diagrams and schematics. They reference and interpret those documents when installing, assembling, diagnosing and repairing electrical components and systems. The translation of two-dimensional and three-dimensional drawings into three-dimensional applications also requires strong document use skills.

Writing
Writing skills are required for construction electricians to record information about their daily work, including hours worked, job locations and details of conversations about the job. They may also be required to record details on an incident or an accident report. They also make notations on as-built drawings to indicate changes from the original drawings, accurately describing the current installation. Labelling and identifying electrical systems also require this skill.

Oral Communication
Strong oral communication skills are needed for construction electricians as they often need to relay messages, give directions, coordinate tasks with co-workers and discuss electrical code requirements with safety or building inspectors. They also regularly interact with supervisors, engineers, owners, architects, inspectors and other tradespersons to solve technical problems, to discuss work progress, and to ensure that work can meet scheduling and code requirements. They also exchange opinions with co-workers regarding critical safety issues related to complex installations.

Numeracy
Construction electricians use their numeracy skills to size and place electrical systems and components, ensuring that installations meet electrical code requirements. They take measurements and perform complex calculations using principles of mathematics such as geometry and trigonometry. Construction electricians also use numeracy skills to design or modify electrical installations.

Thinking Skills
Construction electricians use thinking skills when they plan their work in order to ensure efficient use of time and resources. These skills also entail resolving issues such as system routing, and equipment placement and interconnection taking into account customer specifications and code requirements. Additionally, these skills are called upon when consulting with other experienced tradespersons, manufacturers' representatives or engineers to solve technical problems.

Working with Others
Construction electricians often work with co-workers, other trades, supervisors, owner's representatives, architects, engineers, inspectors and suppliers. They may be required to demonstrate how to perform a task to other workers, and orient or train new employees. They also participate in discussions about work processes or product improvement.

Computer Use
Construction electricians use their computer skills to improve the efficiency of product research, communication, record keeping, job tracking and information exchange with co-workers, other trades, supervisors, owner's representatives, architects, engineers, inspectors and suppliers. They also use different types of software to interface with electrical equipment, such as programmable logic controllers (PLC) and motor control centers (MCC), and to aid in diagnosing system and component failure.

Continuous Learning

It is important for construction electricians to stay up-to-date with changing requirements of the electrical code or with changes in technology, such as computer controls. They must keep an open mind to change to advance their skills and increase their knowledge. These learning skills are applied when attending classes offered through unions, employers and other groups.

BLOCK A COMMON OCCUPATIONAL SKILLS

Trends

New technology such as smart phones and electronic note books are being utilized to improve organization of work site, estimation and ordering. Advancing technology in arc flash gear aids in worker safety. Evolving technology increases efficiency of tools, equipment and materials used by construction electricians.

Related Components

All components apply.

Tools and Equipment

See Appendix A.

Task 1 Performs safety-related functions.

Context

Construction electricians are responsible for ensuring the safety of themselves and others in the work environment. They must follow company and jurisdictional regulations.

It is critical that construction electricians be constantly aware of their surroundings and the hazards they may encounter.

Required Knowledge

K 1	types of personal protective equipment (PPE) such as hard hats, safety glasses, safety footwear, gloves, fall arrest equipment and respiratory protection equipment
K 2	types of safety equipment such as first aid kits and eye wash stations
K 3	certification and training requirements for PPE and safety equipment
K 4	types and operation of fire extinguishing equipment
K 5	location of PPE and safety equipment
K 6	shelf life of PPE and safety equipment
K 7	OH&S regulations
K 8	arc flash ratings and regulations such as National Fire Protection Association (NFPA) 70E and Canadian Standards Association (CSA) Z462
K 9	WHMIS
K 10	company and site safety policies and procedures

K 11	site-specific fire safety and work permit procedures
K 12	emergency procedures for situations such as evacuation, fire and hazardous chemical alarms
K 13	CSA approved equipment
K 14	confined spaces and confined space procedures
K 15	transportation of dangerous goods (TDG) regulations
K 16	lock-out and tagging procedures and legislation governing minimum standards
K 17	safety checks of equipment

Sub-task

A-1.01 Uses personal protective equipment (PPE) and safety equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.01.01	identify site hazards and regulations requiring the use of PPE and safety equipment
A-1.01.02	locate and select PPE and safety equipment such as arc flash kits, fall protection, fire extinguishers and signage appropriate for individual tasks and situations
A-1.01.03	ensure proper fit of PPE such as respirators and face shields
A-1.01.04	recognize worn, damaged or defective PPE and safety equipment such as worn boots and cracked safety glasses
A-1.01.05	report and replace damaged or faulty equipment
A-1.01.06	organize, clean and store PPE and safety equipment according to specifications
A-1.01.07	apply safety regulations such as WHMIS and OH&S
A-1.01.08	recognize limitations of use of PPE and safety equipment

Sub-task

A-1.02 Maintains safe work environment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.02.01	perform housekeeping practices
A-1.02.02	identify, report and correct potential and existing hazards such as arc flashes and oil spills
A-1.02.03	inform surrounding co-workers concerning safety and well-being
A-1.02.04	store materials and equipment
A-1.02.05	identify and respect physical limitations of self and others
A-1.02.06	set up and identify location of safety zone containing components such as first aid kits, fire extinguishers, material safety data sheets (MSDS) and eye wash stations
A-1.02.07	document items such as inspections, potential hazards, safety meetings, injuries and trainings according to regulations
A-1.02.08	participate in safety meetings and tool box meetings
A-1.02.09	enforce safe work practices

Sub-task

A-1.03 Performs lock-out and tagging procedures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-1.03.01	coordinate lock-out and tagging requirements with appropriate authorities and other trades
A-1.03.02	identify circuit for lock-out and tagging, and recognize other equipment that may present a hazard
A-1.03.03	select approved device to ensure proper lock-out and tagging according to regulations
A-1.03.04	identify power source, and de-energize and lock-out equipment

A-1.03.05	test system for zero potential using equipment such as voltmeters and high voltage testers
A-1.03.06	verify proper lock-out and tagging

Task 2 — Uses and maintains tools and equipment.

Context Construction electricians must be able to select, use and maintain tools and equipment in a safe and effective manner relevant to the task being performed.

Required Knowledge

K 1	types of hand tools such as screwdrivers, pliers, wrenches and measuring tapes, and their limitations
K 2	types of power tools such as drills and saws, and their limitations
K 3	types of powder-actuated tools, and their applications and accessories
K 4	certification requirements to operate powder-actuated tools
K 5	manufacturers' specifications, and operating and maintenance instructions
K 6	types of electrical measuring equipment such as multimeters, voltage testers, non-contact voltage testers, insulation resistance meters, clamp ammeters and phase rotation meters
K 7	applications of electrical measuring equipment
K 8	limitations and ratings of electrical measuring equipment
K 9	electrical measuring equipment components such as leads and batteries
K 10	types of specialty tools such as knock-out punches, compression tools, diagnostic tools, benders and cutters, and their limitations
K 11	types of access equipment such as scissor lifts, lift tables, scaffoldings and articulated boom lifts, and their limitations
K 12	certification requirements and regulations regarding the use of access equipment
K 13	safe angles of ladders and three-point contact rule
K 14	worksite surroundings
K 15	certification requirements regarding rigging, hoisting and lifting equipment
K 16	types of rigging, hoisting and lifting equipment and their limitations
K 17	hoisting and lifting considerations such as anchor points, load ratings and environmental conditions

Sub-task

A-2.01 Maintains tools and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.01.01	organize and store tools and components according to specifications
A-2.01.02	clean, sharpen, lubricate and adjust tools and equipment according to specifications
A-2.01.03	ensure calibration of measuring equipment according to specifications
A-2.01.04	identify worn, damaged and defective tools and equipment
A-2.01.05	change tool components such as chucks, bits and blades
A-2.01.06	replace tool components such as cords and attachment plugs
A-2.01.07	repair tools according to specifications
A-2.01.08	identify hazards associated with tools and equipment

Sub-task

A-2.02 Uses access equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.02.01	identify traffic areas and potential hazards such as confined spaces and trenches
A-2.02.02	install barricades and signage to contain work zone
A-2.02.03	select access equipment such as ladders, scissor-lifts, scaffoldings and articulating booms according to task
A-2.02.04	set up and secure step ladders and extension ladders
A-2.02.05	visually and mechanically inspect for worn, damaged and defective access equipment according to specifications, and update documentation
A-2.02.06	report, tag and decommission unsafe, worn, damaged and defective access equipment
A-2.02.07	organize and store access equipment according to specifications
A-2.02.08	work from approved access equipment

Sub-task

A-2.03 Uses rigging, hoisting and lifting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-2.03.01	identify traffic areas and potential hazards such as confined spaces and trenches
A-2.03.02	install barricades and signage to contain work zone
A-2.03.03	use and interpret hand and audible signals
A-2.03.04	select and secure rigging, hoisting and lifting equipment according to application
A-2.03.05	ensure capacity of rigging, hoisting and lifting equipment according to specifications and jurisdictional regulations
A-2.03.06	visually and mechanically inspect for worn, damaged and defective rigging, hoisting and lifting equipment according to specifications
A-2.03.07	report, tag and decommission unsafe, worn, damaged and defective rigging, hoisting and lifting equipment
A-2.03.08	secure load for application according to specifications, jurisdictional regulations and company policy
A-2.03.09	clean, lubricate and store rigging, hoisting and lifting equipment
A-2.03.10	perform minor field maintenance on equipment
A-2.03.11	move load to final position

Task 3 Organizes work.

Context Construction electricians organize projects in order to safely and efficiently use material, labour, tools and equipment. They interpret drawings, plans and specifications to identify required resources. Communication and planning skills are essential to this trade.

Required Knowledge

K 1	regulations such as building codes, the CEC and jurisdictional codes
K 2	OH&S regulations
K 3	code and regulation updates

K 4	components of plans, drawings and specifications such as scaling rulers, legends, details and symbols
K 5	types of documents such as shop drawings and catalogues
K 6	company policies and procedures
K 7	WHMIS
K 8	trade terminology
K 9	project or task to be completed and sequence of operations
K 10	site location, conditions and restrictions
K 11	other trades' work requirements
K 12	delivery dates and availability of materials
K 13	supply authorities' specification requirements and scheduling
K 14	building components such as walls, ceilings and floors
K 15	system components such as panel boards, switchgear and MCC
K 16	work site hazards such as existing utilities, dust, asbestos, temperature, chemicals and weather
K 17	inventory systems
K 18	storage requirements such as temperature, environmental conditions and stacking limitations

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Sub-task

A-3.01 Interprets plans, drawings and specifications.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.01.01	identify symbols found in legend on drawings
A-3.01.02	scale dimensions to determine location of devices
A-3.01.03	locate and cross-reference information on plans, drawings, specifications and contract documents
A-3.01.04	visualize finished product
A-3.01.05	utilize schematics and wiring diagrams to perform tasks such as diagnosing, maintaining and installing systems
A-3.01.06	determine if plans, schematics and drawings are current

Sub-task

A-3.02 Organizes materials and supplies.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.02.01	identify and select materials and supplies according to specifications and CEC
A-3.02.02	locate, order and schedule delivery of material and supplies according to criteria such as storage availability, site schedule and product availability
A-3.02.03	load, unload and store materials and supplies according to factors such as installation sequence and specifications
A-3.02.04	perform material take-off to identify required material and supplies
A-3.02.05	coordinate receiving of materials and supplies to ensure delivery of shipment
A-3.02.06	verify shipments of materials and supplies to ensure that quality and quantity match order
A-3.02.07	perform inventory control

Sub-task

A-3.03 Plans project tasks and procedures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.03.01	visually inspect work environment to determine scope of work from approved documentation
A-3.03.02	determine labour and equipment requirements according to specifications such as wire sizes, load requirements and locations
A-3.03.03	establish and maintain schedules according to criteria such as weather, product availability and project progression
A-3.03.04	coordinate work with other trades for requirements such as shutdown and installation sequencing
A-3.03.05	draw and sketch layouts

Sub-task

A-3.04 Prepares work site.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.04.01	perform pre-job assessment
A-3.04.02	visually inspect to identify traffic areas and potential hazards such as confined spaces and trenches
A-3.04.03	install barricades and signage to contain work zone
A-3.04.04	create openings and penetrations in structures and equipment
A-3.04.05	ensure sufficient lighting and ventilation of work area
A-3.04.06	ensure required materials and equipment are onsite
A-3.04.07	control workplace access
A-3.04.08	ensure surveys and locates are completed and marked-out

Sub-task

A-3.05 Finalizes required documentation.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-3.05.01	document alterations by modifying plans, schematics and drawings to reflect changes and additions made to original application
A-3.05.02	log data from various sources such as variable frequency drive (VFD) parameters, PLC programs and overload settings to assist with maintenance and replacement
A-3.05.03	compile maintenance manuals from installed equipment manufacturers' specifications
A-3.05.04	submit required final documentation, including as-built drawings, to customer

Task 4 — Fabricates and installs support components.

Context Construction electricians fabricate support structures to protect and support equipment and components. They use various methods to secure equipment to structure in order to maintain a safe installation, and reduce hazards and unwanted movements. Seismic restraint systems are used as a secondary support.

Required Knowledge

K 1	types of brackets such as L, U and straight brackets
K 2	types of hangers such as strut, pipe and threaded rod
K 3	types of fasteners such as screws, bolts and anchors
K 4	types of seismic restraint systems
K 5	regulations regarding seismic restraint systems
K 6	specifications and regulations for fastening and supporting components
K 7	supporting weight and shear tensile strength
K 8	equipment such as panel boards, transformers, switchgear and MCCs
K 9	basic construction methods
K 10	metric and imperial measurements
K 11	building materials such as those used in walls, ceilings and floors
K 12	work site hazards such as existing utilities, explosive atmosphere, dust, temperature, chemicals and weather

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Sub-task

A-4.01 Fabricates support structures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.01.01	measure equipment to determine structure size
A-4.01.02	draw scale sketch
A-4.01.03	determine material to be used such as wood, steel and aluminium according to specifications and CEC considering factors such as environment and cost
A-4.01.04	select and use tools and equipment such as chop saws, drills and wrenches
A-4.01.05	select and use fasteners such as nuts, bolts and screws according to specifications and CEC

A-4.01.06	prepare material by cutting to size and drilling holes
A-4.01.07	assemble material to create structure

Sub-task

A-4.02 **Installs brackets, hangers and fasteners.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.02.01	select and use tools and equipment such as hand tools and power tools
A-4.02.02	select brackets, hangers and fasteners according to specifications and CEC
A-4.02.03	determine installation location to avoid obstructions such as duct work, plumbing pipes and equipment
A-4.02.04	secure brackets, hangers and fasteners to structure according to specifications and CEC

Sub-task

A-4.03 **Installs seismic restraint systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	no	no	yes	yes	yes	no	yes	yes	yes	NV	NV	NV

Key Competencies

A-4.03.01	select and use tools and equipment such as crimpers and adjustable pliers
A-4.03.02	select and fabricate seismic restraint systems according to specifications and regulations
A-4.03.03	position, mount and secure seismic restraint systems to structure using material such as aircraft cables, tie wires and chains

Task 5 — Commissions and decommissions electrical systems.

Context Construction electricians commission electrical systems to ensure safe and correct operation. They also shut down systems to perform preventative maintenance or to replace defective equipment. They decommission systems to prepare them for removal.

Required Knowledge

K 1	commissioning procedures such as rotational testing, voltage readings and current readings
K 2	required documentation
K 3	specifications and regulations
K 4	sequence of operation of equipment
K 5	lock-out and tagging procedures
K 6	decommissioning procedures
K 7	testing equipment
K 8	PPE and safety procedures
K 9	equipment ratings such as voltage and current

Sub-task

A-5.01 Performs start-up and shut-down procedures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-5.01.01	identify equipment that need to be energized or de-energized
A-5.01.02	follow specifications sequence for start-up and shut-down
A-5.01.03	test cables for ground faults and phase identification
A-5.01.04	check system peripherals such as detection and alarm systems for correct operation
A-5.01.05	select and use tools and equipment such as megohmmeters, voltmeters and ammeters
A-5.01.06	apply safety ground on shut-down, and remove on start-up
A-5.01.07	verify busbar connections and torquing of bolts

A-5.01.08	verify that safety and shipping material has been removed from equipment and check for tools and loose hardware prior to start-up
A-5.01.09	notify required personnel of start-up and shut-down procedures

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Sub-task

A-5.02 Conducts operational tests.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

A-5.02.01	select and use tools and equipment such as megohmmeters, voltmeters and ammeters
A-5.02.02	check for motor rotation
A-5.02.03	check system peripherals such as detection and alarm systems for correct operation
A-5.02.04	adjust equipment to specifications such as motor overload protections, energy management systems and adjustable circuit breakers
A-5.02.05	perform visual inspections to identify problems
A-5.02.06	adjust components to achieve desired operation
A-5.02.07	perform short-circuit tests on conductors

BLOCK B SYSTEMS, DISTRIBUTION AND SERVICES

Trends	The scope of alternative power systems is expanding and becoming more complex. Construction electricians need to adapt and develop new skills to design and install those systems.
Related Components (including, but not limited to)	Cables, panels, sub-panels, transformers, uninterruptible power supply (UPS) equipment, switchgear, capacitors, motors, cathodic protection equipment, surge protection equipment, meters, generators, turbines, transfer switches, rectifiers, converters, temporary power equipment, conduit, solar panels, control panels, wind turbines, fences, towers, cabinets.
Tools and Equipment	See Appendix A.

Task 6 Installs service entrance and distribution equipment.

Context

The service entrance and distribution equipment provides power for all electrical systems and equipment. Consumer services can provide normal, emergency and temporary power. This equipment allows for the safe utilization of electricity.

Construction electricians install panels, sub-panels and their associated components to distribute power in facilities.

Required Knowledge

K 1	types of supply services such as underground and overhead
K 2	supply service components such as conductors, insulators, meter bases, conduit and panels
K 3	installation methods and conditions pertaining to different environments for supply services
K 4	grounding and bonding methods and requirements
K 5	types of raceways and feeders such as triplex, TECK 90 and R90
K 6	connection methods to consumer service
K 7	types of wiring methods
K 8	installation methods for underground application

K 9	types of metering transformers such as current transformers (CT) and potential transformers (PT)
K 10	types of transformers such as service and distribution transformers
K 11	types of meters such as digital and analog
K 12	supply authority requirements
K 13	types of cabinets and enclosures
K 14	types of fuses such as time delay, high rupture capacity (HRC) and non-time delay
K 15	types of circuit breakers such as mechanical and adjustable
K 16	branch circuit loads and demand factors
K 17	available fault current
K 18	interrupting capacity and ratings of breakers and fuses
K 19	types and clearances of power distribution centres/equipment such as single-phase panel, three-phase panel and MCC
K 20	power and distribution regulations according to CEC and local jurisdictions
K 21	types of portable panels, cables and conductors used for temporary power
K 22	surge protection components such as lightning arresters, ground fault protection and grounding systems
K 23	phase and voltage rating
K 24	types of electrical equipment that require surge protection such as computers, electronic equipment and lighting
K 25	types of power conditioning devices and installation procedures
K 26	power factor and power factor corrections
K 27	requirements for battery bank installations
K 28	types of UPS systems and components such as transfer switches, battery banks and generators
K 29	requirements and uses of UPS systems such as lighting, computers and telephones
K 30	types of panels and sub-panels, and their application
K 31	panel and sub-panel ratings such as current, voltage and capacity
K 32	parallel conductors including the effects of induction
K 33	types of fittings and connectors
K 34	installation and support of panels, sub-panels, feeders and raceways
K 35	line loss and voltage drop

Sub-task

B-6.01 **Installs consumer/supply services.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.01.01	determine size, location and type of service such as overhead, underground and temporary according to specifications, CEC and local supply authorities
B-6.01.02	select components such as supports, conductors, enclosures, raceways and cabinets according to specifications, CEC and local supply authorities
B-6.01.03	select and use tools and equipment such as knock-out cutters, hole saws and drills
B-6.01.04	determine layout of installation according to specifications, CEC and local supply authorities
B-6.01.05	determine trench size and minimum cover requirements to allow for the installation of direct burial cables and underground raceways according to specifications, CEC and local supply authorities
B-6.01.06	erect and secure service components such as conduit and cables
B-6.01.07	mount enclosures and equipment according to specifications, CEC and local supply authorities
B-6.01.08	terminate connections according to specifications, CEC and local supply authorities
B-6.01.09	identify and label components according to specifications and CEC
B-6.01.10	bond and ground components according to specifications and CEC

Sub-task

B-6.02 **Installs metering systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.02.01	select and use tools and equipment such as knock-out cutters, hole saws and drills
B-6.02.02	determine metering requirements according to service size, specifications, CEC and local supply authorities

B-6.02.03	select components such as conductors, enclosures, raceways and cabinets according to specifications and CEC
B-6.02.04	mount components such as metering cabinets, CTs, PTs and related electrical monitoring devices
B-6.02.05	size, install and secure cables, raceways and fittings associated to metering equipment
B-6.02.06	terminate connections using mechanical and compression type fittings
B-6.02.07	identify and label components according to specifications and CEC
B-6.02.08	bond and ground components according to specifications and CEC

Sub-task

B-6.03 Installs overcurrent protection.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.03.01	select and use tools and equipment such as wrenches, hex keys, testers and fuse extractors
B-6.03.02	calculate and set interrupting capacity and trip settings to ensure operation of overcurrent devices
B-6.03.03	determine type of enclosures and overcurrent devices such as time delay fuses, one-time fuses and breakers based on load, environment and equipment type such as lighting and motor loads
B-6.03.04	secure and terminate overcurrent protection using fasteners such as bolts, screws and fuse holders according to specifications and CEC

Sub-task

B-6.04 Installs power distribution centres.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.04.01	select and use tools and equipment
B-6.04.02	determine location and layout of components such as transformers, MCCs and central distribution panels (CDP) according to specifications and CEC

B-6.04.03	mount components and interconnect with required cables, raceways and conductors according to specifications and CEC
B-6.04.04	identify and label components according to specifications and CEC

Sub-task

B-6.05 Installs temporary power.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.05.01	select and use tools and equipment
B-6.05.02	determine cable and system routing and protection according to specifications and CEC
B-6.05.03	protect components from environmental and mechanical damage, and public access
B-6.05.04	select components such as transformers, MCCs, portable sub-stations and CDPs, and determine their location and layout according to specifications and CEC
B-6.05.05	mount components and interconnect with required cables, raceways and conductors according to specifications and CEC
B-6.05.06	install grounding and bonding according to specifications and CEC
B-6.05.07	identify and label components and conductors according to specifications and CEC

Sub-task

B-6.06 Installs surge suppression systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.06.01	select and use tools and equipment
B-6.06.02	create a single line diagram for system engineering and design
B-6.06.03	select components according to specifications and CEC

B-6.06.04	install and connect surge suppression components according to specifications and CEC
B-6.06.05	ensure compatibility with associated electrical systems such as lightning arresters and isolated grounding

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Sub-task

B-6.07 Installs power conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.07.01	select and use tools and equipment such as power quality analyzers and ammeters
B-6.07.02	perform calculations to size transformers
B-6.07.03	size capacitors according to specifications
B-6.07.04	select components such as filters, capacitors and transformers according to specifications and CEC
B-6.07.05	install and interconnect components such as cables, conduit and conductors according to specifications and CEC
B-6.07.06	analyze system output to ensure effectiveness of power conditioning installation
B-6.07.07	install grounding and bonding according to specifications and CEC

Sub-task

B-6.08 Installs uninterruptible power supply (UPS) systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.08.01	select and use tools and equipment
B-6.08.02	determine installation requirements of UPS such as volt/amp (VA) ratings and output according to specifications and CEC
B-6.08.03	verify integrity of support base for UPS according to specifications and CEC

B-6.08.04	position, mount and interconnect UPS components such as transfer switches, battery banks, transformers, inverters and rectifiers according to specifications and CEC
B-6.08.05	install grounding and bonding according to specifications and CEC

Sub-task

B-6.09 Installs panels and sub-panels.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-6.09.01	select and use tools and equipment such as knock-out cutters, hole saws, torque wrenches and hex keys
B-6.09.02	determine requirements and select panels and sub-panels to be installed according to specifications and CEC, and considering factors such as demand, voltage ratings and required circuit capacity
B-6.09.03	measure, lay out and mount panels and sub-panels according to specifications and CEC
B-6.09.04	assemble panel and sub-panel components such as breaker assemblies, dead pan fronts, cover assemblies, and grounding and neutral kits
B-6.09.05	interconnect panels and sub-panels with raceways according to specifications and CEC
B-6.09.06	identify and label panels and sub-panel components according to specifications and CEC

Task 7 — Installs bonding, grounding and cathodic protection systems.

Context

Bonding and grounding systems are used to protect life and equipment from transient and fault current.

Ground fault protection systems are used to protect against electrical shock.

Cathodic protection systems introduce a current onto a tank, pipe or structure to limit corrosion and oxidization.

Required Knowledge

K 1	grounding requirements and components such as rods, plates, electrodes, wires and crimps
K 2	step potential
K 3	bonding requirements and components such as lugs, wires and crimps
K 4	ground fault equipment such as relays and CTs
K 5	applications for ground fault protection systems such as pools, shipyards, kitchens and bathrooms
K 6	installation methods and procedures
K 7	location, clearance and access requirements for ground fault protection systems
K 8	types and purpose of lightning arresters
K 9	components of cathodic protection systems such as controllers and sensors
K 10	purpose of cathodic protection systems
K 11	hazards of working on cathodic protection systems
K 12	rectifier circuits

Sub-task

B-7.01 Installs grounding systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-7.01.01	select and use tools and equipment such as thermit welding equipment, crimping tools, pipe clamps, ground plates and ground rods
B-7.01.02	lay out ground system according to specifications, CEC and local supply authorities
B-7.01.03	excavate area according to specifications, CEC and local supply authorities

B-7.01.04	install and interconnect grounding system components such as ground rods, plates and conductors according to specifications, CEC and local supply authorities
B-7.01.05	perform ground resistance test to verify system

Sub-task

B-7.02 Installs bonding conductors.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-7.02.01	select and use tools and equipment such as hydraulic crimping tools and thermit welding equipment
B-7.02.02	calculate and size bonding conductors according to specifications and CEC
B-7.02.03	plan layout and execution of wire pull considering factors such as location of reels, direction of pull and distribution of workforce
B-7.02.04	terminate bonding conductor according to specifications and CEC

Sub-task

B-7.03 Installs ground fault protection systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-7.03.01	select and use tools and equipment
B-7.03.02	determine type of installation required such as life or equipment protection according to specifications and CEC
B-7.03.03	position, mount and interconnect ground fault system components in enclosure
B-7.03.04	set ground fault protection systems to required specifications and CEC

Sub-task

B-7.04 **Installs lightning arresters.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-7.04.01	select and use tools and equipment such as crimping tools and thermit welding equipment
B-7.04.02	select and lay out lightning protection components such as conductors, ground rods and isolated supports according to specifications and CEC
B-7.04.03	install ground rods according to specifications and CEC
B-7.04.04	position, mount and interconnect lightning arrester components according to specifications and CEC
B-7.04.05	test and verify installation with manufacturer to ensure operation of system

Sub-task

B-7.05 **Installs cathodic protection systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-7.05.01	select and use tools and equipment
B-7.05.02	select components according to specifications and CEC
B-7.05.03	position, mount and interconnect components of cathodic protection systems according to specifications and CEC

Task 8 — Installs power generation systems.

Context Generators and alternative power generation systems can be used when power from the utility is unavailable or the building is isolated from the power grid. Some forms of alternative power generation systems can also feed energy back to the power grid.

Required Knowledge

K 1	types of generators
K 2	types of transfer switches such as manual and automatic
K 3	load requirements
K 4	generator requirements such as clearances, access, ventilation and fuel systems
K 5	operation of transfer switches and generators
K 6	control circuits and alarms for transfer switches and generators
K 7	types of alternative power generation systems such as photovoltaic, tidal and wind
K 8	utility company requirements and regulations regarding alternative power generation systems
K 9	operation of alternative power generation systems
K 10	location of alternative power generation systems for maximum efficiency
K 11	synchronization of generators

Sub-task

B-8.01 Installs generators and transfer switches.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-8.01.01	select and use tools and equipment
B-8.01.02	determine system requirements according to CEC and specifications such as primary and secondary source of power, size of fuel reserve and interconnections
B-8.01.03	verify integrity of base supporting generator
B-8.01.04	determine size of generator and transfer switches according to specifications and CEC

B-8.01.05	place and anchor generator according to specifications
B-8.01.06	install and interconnect components such as transfer switches, utility power, generator and load with cables, raceways and conductors according to specifications and CEC
B-8.01.07	ground and bond generator according to specifications and CEC
B-8.01.08	program generator controls for start-up and shut-down sequences

Sub-task

B-8.02 **Installs alternative power systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-8.02.01	select and use tools and equipment
B-8.02.02	determine scope of work based on specifications
B-8.02.03	install ground grids according to specifications and CEC
B-8.02.04	position, mount and interconnect alternative power system and control system components according to specifications and CEC
B-8.02.05	test and verify installation with manufacturer to ensure operation of system

Task 9 Installs high voltage systems.

Context

Construction electricians assemble, install, erect and connect equipment and cables for high voltage applications such as switchyards, sub-stations and electrical vaults. In these applications, they use specific equipment, tests and procedures to ensure safety.

It is extremely important to perform this work properly and safely due to the inherent hazards in working with high voltage systems that can cause property damage, serious injury or death.

Required Knowledge

K 1	high voltage principles and practices
K 2	types of high voltage equipment such as switchgear, load regulators, transformers, insulators, poles and towers
K 3	grounding, bonding and step potential

K 4	effect of induction
K 5	limits of approach for personal safety
K 6	hazards related to high voltage such as arc flashes
K 7	installation specifications
K 8	location of high voltage equipment such as underground and overhead
K 9	guarding requirements and methods
K 10	bending radius of high voltage cables
K 11	direct burial requirements
K 12	types of cables such as armoured and concentric
K 13	types of conductors such as aluminium and copper
K 14	configurations, spacing and barriers
K 15	marking requirements and practices
K 16	installation materials such as insulators and supports
K 17	high voltage termination techniques
K 18	types of tests such as high potential test, and inductor test and their purpose and requirements
K 19	lockout, testing and grounding procedures for high voltage systems

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Sub-task

B-9.01 Installs high voltage equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-9.01.01	select and use tools and equipment such as torque wrenches and knock-out cutters
B-9.01.02	determine installation requirements such as location and spacing of equipment according to specifications and CEC
B-9.01.03	anchor and assemble high voltage components such as capacitor banks and rectifiers according to specifications and CEC
B-9.01.04	interconnect high voltage components according to specifications and CEC
B-9.01.05	ground and bond electrically conductive components such as fences, towers, doors and enclosures according to specifications and CEC

Sub-task

B-9.02 Installs high voltage cables.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-9.02.01	select and use tools and equipment such as tuggers, cranes, reel jacks and ropes
B-9.02.02	determine layout of installation according to specifications and CEC considering factors such as location of reels and tuggers, direction of pull, distribution of workforce and environment
B-9.02.03	identify and label wires and cables according to specifications and CEC
B-9.02.04	position, mount and secure cables and conductors according to specifications and CEC
B-9.02.05	test and verify integrity of installed conductors using methods such as insulation test and point-to-point

Sub-task

B-9.03 Terminates high voltage cables.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-9.03.01	select and use tools and manufacturers' specified equipment such as cable benders, hydraulic crimpers and cable cutters
B-9.03.02	select termination kit to match cable type according to specifications
B-9.03.03	prepare termination points using techniques such as sanding, vulcanizing and stripping according to specifications
B-9.03.04	install termination kit and lugs according to specifications and CEC
B-9.03.05	secure and support cables according to specifications and CEC

Sub-task

B-9.04 **Tests high voltage systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-9.04.01	select and use test equipment
B-9.04.02	verify installation according to specifications and CEC to ensure integrity of installation
B-9.04.03	isolate components to perform and allow for safe testing procedures
B-9.04.04	perform tests, such as high potential and insulation tests, on equipment and conductors according to specifications
B-9.04.05	discharge residual capacitance from high voltage cables
B-9.04.06	interpret test data to verify integrity of system and compliance with specifications before re-energization

Task 10 Installs transformers.

Context Construction electricians install extra-low, low and high voltage transformers to condition or alter voltage and current. Common transformer uses include control, isolation, distribution and transmission.

Required Knowledge

K 1	sizes and types of transformers such as dry, oil-filled, single-phase and three-phase
K 2	transformer installation procedures and location
K 3	tap settings
K 4	purpose of transformers such as step-up, step-down and isolation
K 5	transformer clearances
K 6	transformer winding configuration
K 7	purpose of transformer grounding
K 8	conductor spacing and insulation for different applications

Sub-task

B-10.01 **Installs extra low voltage transformers.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-10.01.01	select and use tools and equipment
B-10.01.02	determine supply voltage and required output VA rating
B-10.01.03	determine location of transformer to be installed and required enclosures
B-10.01.04	position, mount and interconnect components according to specifications and CEC

Sub-task

B-10.02 **Installs low voltage transformers.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-10.02.01	select and use tools and equipment
B-10.02.02	determine system requirements, such as input/output voltage, phasing, VA ratings, wire size and overcurrent protection, according to specifications and CEC
B-10.02.03	determine and select transformers according to location, intended use, specifications and CEC
B-10.02.04	position, mount and interconnect components according to specifications and CEC
B-10.02.05	select and change tap settings of transformers
B-10.02.06	ground and bond according to specifications and CEC
B-10.02.07	perform tests, such as high potential and insulation tests, on equipment according to specifications and CEC

Sub-task

B-10.03 Installs high voltage transformers.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

B-10.03.01	select and use tools and equipment
B-10.03.02	determine system requirements, such as input/output voltage, VA ratings, wire size and overcurrent protection, according to specifications and CEC
B-10.03.03	determine and select transformers according to location, intended use, specifications and CEC
B-10.03.04	position, mount and interconnect components according to specifications and CEC
B-10.03.05	select and change tap settings of transformer
B-10.03.06	ground and bond according to specifications and CEC
B-10.03.07	perform tests, such as high potential and insulation tests, on equipment according to specifications and CEC

BLOCK C WIRING METHODS

Trends	The industry is moving toward energy-saving and environmentally friendly devices such as photo-luminescent lighting, LED lighting and alternative emergency systems. User friendly components such as quick connectors for cable and fluorescent lighting are becoming commonplace. Ergonomically designed connectors are making installation easier and faster.
Related Components (including, but not limited to)	Conduit, cables, boxes, straps, fittings, raceways, devices, luminaires, conductors, splitters, cabinets, electric heaters, heating cables, overcurrent devices, batteries, lighting and mechanical control devices.
Tools and Equipment	See Appendix A.

Task 11 Installs raceways and cables.

Context Construction electricians install raceways, conductors and cables to interconnect components. The raceways support and protect conductors. Enclosures may be used to access and terminate the content of the raceway, and to facilitate the pulling and the interconnection of components. Raceways and cables are installed in various environments.

Required Knowledge

K 1	types and sizes of raceways such as conduit, tray, floor duct and cellular floors
K 2	types of fittings such as couplings and connectors
K 3	installation requirements such as number of bends, support spacing and types of supports
K 4	cable types and applications
K 5	installation environment
K 6	types of cable supports and fasteners such as staples and straps
K 7	termination requirements such as connectors, anti-oxidants and bushings
K 8	pulling tension for cable installation
K 9	types of underground conduit and cable

K 10	conductor protection, marking and spacing
K 11	underground wiring techniques
K 12	types of enclosures such as boxes and cabinets
K 13	clearances and accessibility
K 14	sizing requirements for enclosures
K 15	size, number and types of conductors
K 16	lubricants
K 17	fishing techniques and related hazards

Sub-task

C-11.01 Installs raceways.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-11.01.01	select and use tools and equipment such as pipe benders, hammer drills and wrenches
C-11.01.02	determine installation requirements such as route, height, supports and space availability according to specifications and CEC
C-11.01.03	select components according to the installation environment such as weathertight, dust-tight and explosion-proof fittings
C-11.01.04	measure, cut, bend and assemble raceway components according to specifications and CEC considering factors such as environment and site conditions
C-11.01.05	determine layout of raceway components such as fittings, straps and pipes for ease of installation
C-11.01.06	position, mount and support raceways according to specifications and CEC

Sub-task

C-11.02 Installs cables.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-11.02.01	select and use tools and equipment such as cable cutters, cable strippers and tuggers
C-11.02.02	determine installation requirements such as route, height, supports and space availability according to specifications and CEC
C-11.02.03	select cables, connectors and supports according to specifications and CEC
C-11.02.04	select components according to the installation environment such as weathertight, dust-tight and explosion proof fittings
C-11.02.05	measure, cut, bend and assemble cable components according to specifications and CEC considering factors such as environment and site conditions
C-11.02.06	position, mount and support components such as fittings, straps and cables according to specifications and CEC
C-11.02.07	terminate cables

Sub-task

C-11.03 Installs underground cables and raceways.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-11.03.01	ensure area is marked by supply authorities for existing utility services
C-11.03.02	select and use tools and equipment such as shovels, hacksaws and trenchers
C-11.03.03	determine installation requirements such as route, depth, supports and protection according to specifications and CEC
C-11.03.04	select cables, raceways and supports according to specifications and CEC considering factors such as environment and site conditions
C-11.03.05	measure, cut, bend and assemble underground cable and raceway components according to specifications and CEC considering factors such as environment and site conditions

C-11.03.06	install components such as fittings and chair rails for cable and raceway installation
C-11.03.07	position, support, protect and mark cables and raceways according to specifications and CEC
C-11.03.08	mark and backfill trenches according to specifications and CEC

Sub-task

C-11.04 Installs enclosures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-11.04.01	select and use tools and equipment such as levels, measuring tapes and drills
C-11.04.02	determine installation requirements such as location, supports, accessibility and clearances according to specifications and CEC
C-11.04.03	select components according to installation requirements, specifications and CEC
C-11.04.04	prepare enclosure for installation requirements such as knockouts for cables or raceways according to specifications and CEC
C-11.04.05	position and mount enclosure according to specifications and CEC
C-11.04.06	mark enclosure according to specifications and CEC

Sub-task

C-11.05 Installs conductors in raceways.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-11.05.01	select and use tools and equipment such as fish tapes, linesman pliers, wire racks and tuggers
C-11.05.02	determine installation requirements such as wire size, wire type, wire length, derating of wire ampacity and fill requirements according to specifications and CEC
C-11.05.03	select conductors and materials such as rags, lubricant, polytwine and labels according to specifications and CEC

C-11.05.04	mark and identify conductors according to specifications and CEC
C-11.05.05	prepare raceways for installation using fish tapes or pull ropes
C-11.05.06	lubricate, feed and draw conductors into raceways according to specifications and CEC

Task 12 Installs branch circuitry.

Context Various devices and fixtures are installed by construction electricians to meet the power and lighting requirements of the end users. They are installed in a manner which makes the power safe and convenient to use. Lighting systems are used to properly illuminate specified areas according to consumer needs. Lighting controls adjust lighting levels and save power.

Required Knowledge

K 1	types, functions and applications of luminaires
K 2	types of fasteners
K 3	structure surfaces such as T-bar, concrete and steel
K 4	installation environment and classification
K 5	types of supports such as chains, cables and boxes
K 6	support and protection requirements
K 7	branch circuitry installation procedures related to components such as light posts, branch circuit protection and devices
K 8	types of devices and lighting controls such as relays, dimming systems, photocells, motion sensors and timers
K 9	operation of lighting control systems
K 10	types of light posts such as street lights, traffic lights, bollard lights and parking lights
K 11	uses and requirements of light posts
K 12	types of branch circuit protection such as circuit breakers, fuses and ground fault protection
K 13	conductor sizes and ampacity
K 14	available fault current
K 15	other trades' activities in order to coordinate work completion schedules

Sub-task

C-12.01 Installs luminaires.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-12.01.01	select and use tools and equipment such as levels, measuring tapes and light meters
C-12.01.02	determine circuitry and demand load according to specifications and CEC
C-12.01.03	assemble luminaires according to specifications
C-12.01.04	position, mount and support luminaires to structure according to specifications and CEC
C-12.01.05	position, mount and secure seismic restraint systems to structure using material such as aircraft cables, tie wires and chains
C-12.01.06	terminate connections according to specifications and CEC
C-12.01.07	install lamps

Sub-task

C-12.02 Installs wiring devices.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-12.02.01	select and use tools and equipment such as screwdrivers, strippers and linesman pliers
C-12.02.02	determine device configuration and ratings according to specifications and CEC
C-12.02.03	terminate connections according to specifications and CEC
C-12.02.04	position and mount devices to enclosure
C-12.02.05	select and install faceplates and covers

Sub-task

C-12.03 Installs lighting controls.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-12.03.01	select and use tools and equipment such as screwdrivers, strippers and linesman pliers
C-12.03.02	determine control components according to specifications and CEC
C-12.03.03	determine circuitry and demand load according to specifications and CEC
C-12.03.04	assemble control components such as time clocks, photo cells and motion sensors
C-12.03.05	position and mount lighting controls
C-12.03.06	terminate connections according to specifications and CEC
C-12.03.07	program lighting controls

Sub-task

C-12.04 Installs light posts.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-12.04.01	select and use tools and equipment such as levels, wrenches and hydraulic crimpers
C-12.04.02	fit fabricated bases with components such as conduit, sleeves, anchoring bolts, studs and breakaway bolts according to specifications and CEC
C-12.04.03	assemble and erect light posts according to specifications and safety regulations
C-12.04.04	position, mount and shim according to specifications
C-12.04.05	terminate connections according to specifications and CEC and ground light post
C-12.04.06	adjust and aim luminaires according to specifications and CEC

Sub-task

C-12.05 Installs branch circuit protection.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-12.05.01	select and use tools and equipment
C-12.05.02	determine and calculate demand load according to specifications and CEC
C-12.05.03	determine overcurrent protection requirements and components such as fuses and breakers according to manufacturers' enclosure
C-12.05.04	determine special requirements and components such as ground fault circuit interrupters (GFCI) and arc fault breakers according to specifications and CEC
C-12.05.05	position and mount branch circuit protection devices according to specifications and CEC
C-12.05.06	terminate connections according to specifications and CEC
C-12.05.07	update documentation such as panel and maintenance schedule to reflect installation purpose and date according to specifications and CEC

Task 13 Installs heating, ventilation and cooling (HVAC) systems.

Context Construction electricians install and connect electric heating systems. Cooling, ventilation and some heating systems can be supplied by other trades but are electrically connected by construction electricians. They may also be responsible for the installation and wiring of control devices.

Required Knowledge

K 1	types of electric heating systems
K 2	types of fasteners
K 3	installation environment and classification
K 4	electric heating installation procedures
K 5	heat loss and heat requirement calculations
K 6	types of cooling systems such as refrigeration and air conditioning
K 7	connection procedures
K 8	HVAC system operational requirements

K 9	electrical control devices such as thermostats, sensors and timers
K 10	mechanical control devices such as solenoid valves, dampers and relays
K 11	control device location and accessibility requirements

Sub-task

C-13.01 Installs electric heating systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-13.01.01	select and use tools and equipment
C-13.01.02	calculate demand load according to specifications and CEC to select heating system
C-13.01.03	determine branch circuit requirements to select components according to specifications and CEC
C-13.01.04	determine location of installation according to specifications and CEC
C-13.01.05	assemble, position and mount device
C-13.01.06	terminate connections according to specifications and CEC

Sub-task

C-13.02 Connects HVAC systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-13.02.01	select and use tools and equipment
C-13.02.02	determine installation requirements such as wire size, overcurrent protection and disconnect means according to specifications and CEC
C-13.02.03	terminate connections according to specifications and CEC

Sub-task

C-13.03 Installs HVAC control systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-13.03.01	select and use tools and equipment
C-13.03.02	determine installation requirements and components such as thermostats, humidistats and damper motors according to specifications and CEC
C-13.03.03	position, mount, interlock and interconnect electrical control devices according to specifications and CEC
C-13.03.04	calibrate, program and verify control devices

Task 14 Installs emergency lighting systems.

Context Emergency lighting systems are used to facilitate safe egress from buildings during emergency situations. The size and location of lighting systems are determined by building codes. These systems can be powered by batteries or generators.

Required Knowledge

K 1	types of exit lighting such as self-powered and remote-powered
K 2	building code requirements for spacing and location
K 3	alternating current (AC) and direct current (DC) circuit requirements
K 4	types of fasteners
K 5	installation environment and classification
K 6	types of emergency power supplies such as batteries and generators
K 7	types of battery-operated lighting
K 8	battery types and sizing

Sub-task

C-14.01 Installs exit lighting.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-14.01.01	select and use tools and equipment
C-14.01.02	determine location requirements according to specifications and CEC
C-14.01.03	determine and calculate electrical requirements according to specifications and CEC
C-14.01.04	position, mount and assemble exit lighting according to specifications and CEC
C-14.01.05	terminate connections
C-14.01.06	integrate exit lighting and emergency lighting

Sub-task

C-14.02 Installs battery-operated lighting.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

C-14.02.01	select and use tools and equipment
C-14.02.02	determine location requirements according to specifications and CEC
C-14.02.03	determine and calculate lighting requirements such as battery demand load and distance according to specifications and CEC
C-14.02.04	position, mount, assemble and connect emergency light systems
C-14.02.05	adjust and aim luminaires according to specifications and CEC
C-14.02.06	integrate exit lighting and emergency lighting

BLOCK D MOTORS AND CONTROL SYSTEMS

Trends	Industry demands smaller, more efficient, intelligent and cost-effective motors and controls. Therefore, construction electricians need to stay current with this technology as it is continually evolving.
Related Components (including, but not limited to)	AC and DC motors, starters, overload devices, control devices, push button stations, probes and sensors, actuators, shims, PLCs, VFDs, computers, software.
Tools and Equipment	See Appendix A.

Task 15 Installs motor controls and protection.

Context Motors that drive equipment need to be controlled. These controls can be as simple as a switch, or as complex as a PLC. Motors also need to be protected from adverse conditions that affect their performance and longevity. Construction electricians select and install control and protection devices in the motor circuits.

Required Knowledge

K 1	types of starters such as full voltage, reduced voltage, manual and magnetic starters
K 2	types of enclosures such as dry, wet and hazardous
K 3	types of VFDs and their parameters
K 4	motor specifications and nameplates
K 5	motor sizes, types and characteristics
K 6	line and load conditioning
K 7	harmonics
K 8	types, rating and sizing of overload protection devices
K 9	types, rating and sizing of overcurrent protection devices
K 10	types of motor controls
K 11	system requirements and applications
K 12	control devices such as float and interlock switches

K 13	multiple voltage systems
K 14	automated control systems
K 15	interface requirements

Sub-task

D-15.01 Installs starters.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-15.01.01	determine type of starter control for specific application
D-15.01.02	determine size and function of starter according to manufacturers' nameplate data such as size of motor, full load amps (FLA), service factor and voltage
D-15.01.03	select and use tools and equipment
D-15.01.04	calculate feeder requirements according to specifications and CEC
D-15.01.05	mount, assemble and connect starter assembly according to functionality
D-15.01.06	set up and adjust starters
D-15.01.07	interconnect starter with cables, raceways and conductors according to specifications and CEC

Sub-task

D-15.02 Installs variable frequency drives (VFD).

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-15.02.01	determine type of VFD control for specific application
D-15.02.02	determine size and function of VFD according to manufacturers' nameplate data such as size of motor, FLA and voltage
D-15.02.03	select and use tools and equipment
D-15.02.04	calculate feeder requirements according to specifications and CEC taking into account special conditions such as shielding requirements, length of cable and line reactor
D-15.02.05	position, mount and connect VFD

D-15.02.06	calibrate and program VFD according to functionality and established parameters
D-15.02.07	interconnect with required cables, raceways and conductors according to specifications and CEC

Sub-task

D-15.03 Installs overload protection.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-15.03.01	calculate overload protection requirements according to manufacturers' motor nameplate data, specifications and CEC
D-15.03.02	select and use tools and equipment
D-15.03.03	position, mount and connect overload protection device according to specifications and CEC
D-15.03.04	select and adjust overload protection device according to specifications and CEC
D-15.03.05	interconnect with components such as starters, contactors and auxiliary contacts according to specifications and CEC

Sub-task

D-15.04 Installs automated control systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-15.04.01	select automated controls according to peripherals such as start-stop stations, motors, photo eyes and proximity sensors
D-15.04.02	determine power supply requirements for peripherals
D-15.04.03	select and use tools and equipment
D-15.04.04	position, mount, assemble and connect automated controls and interface components according to specifications and CEC
D-15.04.05	write and verify automated control program according to specifications

D-15.04.06	test automated control program and adjust
D-15.04.07	interconnect with required cables, raceways and conductors according to specifications and CEC

Sub-task

D-15.05 Installs motor overcurrent protection.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-15.05.01	calculate overcurrent requirements according to manufacturers' motor nameplate data, specifications and CEC
D-15.05.02	select overcurrent protection devices and enclosures according to specifications and CEC
D-15.05.03	select and use tools and equipment
D-15.05.04	position, mount and connect overcurrent protection devices according to specifications and CEC
D-15.05.05	interconnect with required cables, raceways and conductors according to specifications and CEC

Task 16 Installs motors.

Context Construction electricians install motors to convert electrical energy to mechanical energy.

Required Knowledge

K 1	types of motors such as single-phase, three-phase and DC
K 2	motor applications
K 3	power, starting and duty requirements
K 4	installation environment and classification
K 5	electrical system requirements
K 6	types and sizes of fuses and breakers
K 7	types of motor starters

K 8	types of conductors
K 9	selection of required motor rotation

Sub-task

D-16.01 Installs alternating current (AC) motors.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-16.01.01	determine type of AC motor required according to criteria such as voltage availability, motor function and location
D-16.01.02	select and use tools and equipment
D-16.01.03	determine conductor size according to manufacturers' motor nameplate data, specifications and CEC
D-16.01.04	ensure that overload and overcurrent devices are installed to protect motor
D-16.01.05	finalize connection of motor leads according to specifications and CEC
D-16.01.06	ensure that control devices are installed for motor controls
D-16.01.07	position and mount motor
D-16.01.08	verify rotation to ensure operation
D-16.01.09	align and interconnect motor to equipment such as blowers, pumps and compressors
D-16.01.10	interconnect with required cables, raceways and conductors according to specifications and CEC

Sub-task

D-16.02 Installs direct current (DC) motors.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

D-16.02.01	determine type of DC motor required according to criteria such as voltage availability, motor function and location
D-16.02.02	select and use tools and equipment

D-16.02.03	determine conductor size according to manufacturers' motor nameplate data, specifications and CEC
D-16.02.04	ensure that overload and overcurrent devices are installed to protect motor
D-16.02.05	finalize connection of conductors within motor circuit according to specifications and CEC
D-16.02.06	ensure that control devices are installed for motor controls
D-16.02.07	position and mount motor
D-16.02.08	verify rotation to ensure operation
D-16.02.09	align and connect motor to equipment for commercial, industrial and manufacturing applications
D-16.02.10	interconnect with required cables, raceways and conductors according to specifications and CEC

BLOCK E SIGNALLING AND COMMUNICATION SYSTEMS

Trends

The industry is increasingly moving towards the use of communication systems and away from signalling systems. The automation of building operation functions is becoming more sophisticated. Satellite radio and television is becoming more common, reducing the need for land-based communication systems.

Related Components (including, but not limited to)

Conductors, cables, raceways, racks, panels, enclosures.

Tools and Equipment

See Appendix A.

Task 17 Installs signalling systems.

Context

Construction electricians install signalling systems which allow for the protection and management of people and property. These types of systems may be low voltage circuit or extra low voltage circuit.

Required Knowledge

K 1	codes and regulations applying to fire alarm system installation
K 2	types and components of fire alarm systems
K 3	wiring methods
K 4	manufacturers' specifications
K 5	ancillary devices and circuits such as fan shut down, elevator recall and door release
K 6	types and components of nurse call systems
K 7	types of security systems such as card access, door access and intrusion
K 8	types of surveillance systems such as video, motion and heat
K 9	operating principles of signalling systems

Sub-task

E-17.01 Installs fire alarm systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-17.01.01	select and use tools and equipment
E-17.01.02	determine fire alarm system requirements such as addressable and non-addressable systems according to specifications and CEC
E-17.01.03	determine system layout according to specifications, CEC and the National Building Code (NBC)
E-17.01.04	select system components such as fire alarm panels, heat sensors and horn/strobes
E-17.01.05	position, mount and assemble system components according to specifications and CEC
E-17.01.06	terminate and interconnect components and associated systems according to specifications and CEC
E-17.01.07	ground and bond according to specifications and CEC

Sub-task

E-17.02 Installs nurse call systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-17.02.01	select and use tools and equipment
E-17.02.02	determine nurse call system requirements such as audible, visual or combination according to specifications and CEC
E-17.02.03	determine system layout according to specifications and CEC
E-17.02.04	select system components such as switches, push buttons and pull cords
E-17.02.05	position, mount and assemble system components according to specifications and CEC
E-17.02.06	terminate and interconnect components and associated systems according to specifications and CEC
E-17.02.07	ground and bond according to specifications and CEC

Sub-task

E-17.03 **Installs security and surveillance systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-17.03.01	select and use tools and equipment such as coaxial cable terminating tools and crimpers
E-17.03.02	determine security and surveillance system requirements according to specifications and CEC
E-17.03.03	determine system layout according to specifications and CEC
E-17.03.04	select system components such as cameras, monitors, digital video recorders (DVR) and motion sensors
E-17.03.05	position, mount and assemble system components according to specifications and CEC
E-17.03.06	terminate and interconnect components and associated systems according to specifications and CEC

Task 18 Installs communication systems.

Context Communication systems allow information to be transmitted from one point to another, using different methods and materials such as fibre optic, category class and coaxial cables. These types of systems may be low voltage power circuit, extra low voltage power circuit or low energy power circuit.

Required Knowledge

K 1	types of cables such as fibre optic, category class and coaxial
K 2	installation standards according to specifications and CEC
K 3	manufacturers' specifications such as bend radius, jacket stripping and splicing
K 4	types of communication signals such as analog and digital
K 5	types of public address (PA) systems
K 6	community antenna distribution, and radio and television equipment
K 7	types of building automation systems such as energy management systems, integrated building systems and smart buildings

K 8	components of building automation systems such as cables and sensors
K 9	test equipment such as optical time-domain reflectometer (OTDR) testers and data testers
K 10	Class 1 and 2 circuitry

Sub-task

E-18.01 Installs voice/data systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-18.01.01	select and use tools and equipment such as cable terminating tools, network testers and crimpers
E-18.01.02	determine voice/data system requirements according to specifications and CEC
E-18.01.03	determine system layout according to specifications and CEC
E-18.01.04	select system components such as ports, routers and monitors
E-18.01.05	position, mount and assemble system components according to specifications and CEC
E-18.01.06	terminate and interconnect components and associated systems according to specifications and CEC
E-18.01.07	test and label system components, and document results

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Sub-task

E-18.02 Installs public address (PA) systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-18.02.01	select and use tools and equipment
E-18.02.02	determine PA system requirements according to specifications and CEC
E-18.02.03	determine system layout according to specifications and CEC
E-18.02.04	select system components such as speakers, microphones and control units

E-18.02.05	position, mount and assemble system components according to specifications and CEC
E-18.02.06	terminate and interconnect components and associated systems according to specifications and CEC

Sub-task

E-18.03 **Installs community antenna distribution, and radio and television systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-18.03.01	select and use tools and equipment
E-18.03.02	determine system requirements according to specifications and CEC
E-18.03.03	determine system layout according to specifications and CEC
E-18.03.04	select system components such as broadcast transmitters, receiving equipment, noise suppressors and satellite dishes
E-18.03.05	position, mount and assemble system components according to specifications and CEC
E-18.03.06	terminate and interconnect components and associated systems according to specifications and CEC
E-18.03.07	ground and bond according to specifications and CEC

Task 19 Installs integrated control systems.

Context Integrated control systems and building automation systems involve connecting building components through a computerized system in order to achieve automated control over systems such as HVAC, lighting and security systems.

Required Knowledge

K 1	types of cables such as category 6 (CAT-6), fibre optic and RG 6 coaxial
K 2	installation standards
K 3	manufacturers' specifications such as bend radius, terminating methods and pull tensions

K 4	types of communication standards such as analog and digital
K 5	types of PA and intercom systems
K 6	community antenna distribution, and radio and television equipment
K 7	types of building automation systems such as energy management systems, integrated building systems and smart buildings
K 8	components of building automation systems such as cables, sensors and controllers

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Sub-task

E-19.01 **Installs building automation systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-19.01.01	select and use tools and equipment such as data punch down, toner and soft wraps
E-19.01.02	determine system requirements and compatibility with the building management system according to specifications and CEC
E-19.01.03	determine system layout according to specifications and CEC
E-19.01.04	select system components such as fibre boards, sensors and cables
E-19.01.05	position, mount and assemble system components
E-19.01.06	terminate and interconnect components and associated systems according to specifications and CEC
E-19.01.07	program system according to specifications

Sub-task

E-19.02 **Installs building control systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

E-19.02.01	select and use tools and equipment
E-19.02.02	determine system requirements and compatibility with the building management system according to specifications and CEC

E-19.02.03	determine system layout according to specifications and CEC
E-19.02.04	select system components such as damper motors, valves, thermostats and sensors
E-19.02.05	position, mount and assemble system components
E-19.02.06	terminate and interconnect components and associated systems according to specifications and CEC
E-19.02.07	program system according to specifications

BLOCK F UPGRADING, SERVICE AND MAINTENANCE

Trends Predictive maintenance using equipment such as infrared detection and specialized test equipment is becoming more common. Therefore, construction electricians are becoming more efficient regarding the diagnostic process, improving their ability to prevent system downtime and equipment failure.

Related Components All components apply.

Tools and Equipment See Appendix A.

Task 20 Upgrades electrical systems.

Context Construction electricians are required to be familiar with electrical systems and the options that are available to upgrade and improve them. Reasons for upgrading include meeting the customer's requirements such as comfort, cost saving, environmental factors and convenience.

Required Knowledge

K 1	system components such as MCCs, transformers, panel boards and splitters
K 2	types of electrical systems and their use
K 3	building system operations such as HVAC, fire alarms and control systems
K 4	service calculation and demand factors
K 5	code rules and jurisdictional regulations
K 6	removal and disposal procedures
K 7	design changes to electrical systems
K 8	de-energizing, lock-out, tag-out and system testing procedures

Sub-task

F-20.01 Evaluates existing electrical systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-20.01.01	select and use tools and equipment
F-20.01.02	determine existing electrical installation and assess compatibility for required changes according to specifications and CEC
F-20.01.03	determine upgrades to meet specifications and CEC
F-20.01.04	list upgrade options to client

Sub-task

F-20.02 Replaces electrical systems and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-20.02.01	select and use tools and equipment
F-20.02.02	determine electrical system and equipment requirements according to specifications and CEC
F-20.02.03	determine layout for equipment or system to be replaced according to specifications and CEC
F-20.02.04	select system components to be installed
F-20.02.05	remove existing components and dispose according to specifications
F-20.02.06	position, mount, assemble and interconnect replacement components according to specifications and CEC
F-20.02.07	update required documentation such as schematic diagrams, and maintenance and panel schedules to reflect installation

Task 21 Services electrical systems.

Context Construction electricians respond to service demands from clients. They diagnose and repair defective components to maintain operation of all electrical systems. Construction electricians need to return equipment to operation in a timely manner.

Required Knowledge

K 1	types of electrical systems
K 2	electrical system design and operation
K 3	diagnostic techniques
K 4	schematic, diagrams and specifications
K 5	electrical components and supply availability
K 6	organizational and planning skills
K 7	de-energizing, lock-out, tag-out and system testing procedures

Sub-task

F-21.01 Diagnoses electrical systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-21.01.01	obtain detailed description of the malfunction from client to assist in diagnosis
F-21.01.02	select and use tools and equipment
F-21.01.03	conduct field assessment such as a sensory and technical inspections using devices such as multimeters and voltage testers
F-21.01.04	determine source of malfunction based on field assessment
F-21.01.05	determine course of action

Sub-task

F-21.02 **Repairs electrical components.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-21.02.01	select and use tools and equipment
F-21.02.02	recognize defective electrical components
F-21.02.03	select equivalent replacement components
F-21.02.04	remove defective components
F-21.02.05	install replacement components with minimal disruptions and interruptions
F-21.02.06	clean, lubricate and adjust components
F-21.02.07	record and update documentation to reflect repair

Task 22 Maintains electrical systems.

Context Maintenance requires the construction electrician to establish and follow a schedule that predicts and prevents potential failures.

Required Knowledge

K 1	system design and sequence of operations
K 2	cleaners and lubricants
K 3	operation of equipment
K 4	equipment being maintained
K 5	manufacturers' specifications
K 6	customer requirements
K 7	environmental conditions
K 8	safety requirements

Sub-task

F-22.01 Implements maintenance schedule.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-22.01.01	determine maintenance requirements according to specifications
F-22.01.02	create maintenance schedule based on maintenance requirements
F-22.01.03	follow maintenance schedule
F-22.01.04	record and update maintenance schedule data

Sub-task

F-22.02 Tests system operation.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-22.02.01	select and use tools and equipment such as infrared cameras, lumen meters and tachometers
F-22.02.02	conduct tests according to maintenance schedule and specifications
F-22.02.03	record test results in maintenance schedule
F-22.02.04	compare and analyze test results to recognize potential system operation problems from maintenance schedule data

Sub-task

F-22.03 Maintains electrical components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV	NV	NV

Key Competencies

F-22.03.01	select and use tools and equipment
F-22.03.02	follow maintenance schedule according to specifications

F-22.03.03	select and apply cleaners
F-22.03.04	select and apply lubricants
F-22.03.05	carry out mechanical and electrical adjustments such as re-torquing of lugs and testing of battery packs
F-22.03.06	record and update maintenance schedule data

APPENDICES

APPENDIX A TOOLS AND EQUIPMENT

Standard Tools

adjustable wrench
awl
cable cutter
camera
caulking gun
centre punch
chalk line
cold chisel
combination square
combination wrench set
crimping pliers
crowbar
drill bits
files
fish tape
flashlight
fuse puller
hack saw
hammers
hex key set
keyhole saw
knives
knockout cutter
linesman pliers
measuring tape
needle nose pliers
nut drivers
pipe benders
pipe cutters
pipe threader
pipe wrench
reamers (EMT and rigid)
screwdrivers – Robertson, Phillips, torx, flat, tamper-proof
side/diagonal cutters
slip joint pliers
socket set
speed wrench
tap and die set
tin snips
tool belt
tool bucket
torpedo level
triple tap
trouble light
vise
wire strippers
wood chisel

Access Equipment

articulated boom lift
boom lifts
construction elevator
ladders (extension, fixed, step)
lift table
scaffolds (rolling, mechanical, stationary, ladder jack)
scissor lift
swing stage

Personal Protective Equipment and Safety Equipment

arc flash equipment
barricades
confined space equipment
coveralls (fire retardant)
ear plugs and muffs
eye wash facilities
face shield
fall arresters
fire blanket
fire extinguisher
first aid equipment
fume and toxic gas detector
gloves
goggles
grounding straps
hard hat
insulated gloves
knee pads
lanyard
life line
lock-out kit
portable light
pylons
respirator
restraint device
rope grab
safety belt
safety boots
safety glasses
safety harness
safety vest
self contained breathing apparatus
signage
ventilation equipment
warning tape

Power Tools and Equipment

band saws
battery/rechargeable drill
bench grinder
chop saw
circular saw
core drill
drill press
grinder
heat gun
hammer drill
hole saw kit
hydraulic bender
hydraulic crimper
jig saw
magnetic drill
pneumatic hammer drill
power cable feeders
power drill
power pipe bender
power pipe cutters
power pipe threader
power puller
power reel lift
PVC bender
reciprocating saw
sump pump
tugger
vacuum

Specialty Tools and Equipment

chain falls
come-along
communication devices (cellphones and 2-way radio)
creepers and crawlers
extension cords
grip hoist
hot stick
inverters
knock-out punch
laser level
manual hoist
picks
pneumatic hoist
portable generator
powder-actuated tools
reel jacks
rope
shackles
shovels
sledgehammer
slings
spud wrench
soldering apparatus
strain relief grips
thermit (thermal) welder
torque wrench
wire rack

Measuring Equipment

ammeter
cable locator
clamp ammeter
fault locator
frequency meter
ground megohmmeter
hi-pot tester (dielectric tester)
inductive voltage detector
insulation resistance meter
jumpers
LAN meter (cable analyser)
light meter
megohmmeter (insulation tester)
motor rotation meter
multimeter
optical time-domain reflectometer (OTDR)
ohmmeter
oscilloscope
phase rotation meter
recording meter (watts, volts and amps)
tachometer
thermographic imaging camera
thermometer (infra red and electronic)
ultrasonic testing equipment
voltage tester
voltmeter
watt meter

APPENDIX B GLOSSARY

ancillary	functions performed by the fire alarm system as an output of the fire alarm system, controlled by a relay or similar device, for example, elevator recall, fan shut down and door release
bonding	a low impedance path obtained by permanently joining all non-current-carrying metal parts to assure electrical continuity and having the capacity to conduct safely any current likely to be imposed on it
cathodic protection	technique to control the corrosion of a metal surface by making that surface the cathode of an electrochemical cell
extra low voltage	any voltage up to and including 30 volts
grounding	a permanent and continuous conductive path to the earth with sufficient ampacity to carry any fault current liable to be imposed on it, and of a sufficiently low impedance to limit the voltage rise above ground and to facilitate the operation of the protective devices in the circuit
low energy power circuit	a circuit where the power is limited to 100/V Amperes where V is the open circuit voltage
luminaires	a complete lighting unit designed to accommodate the lamp(s) and to connect the lamp(s) to circuit conductors, for example, florescent, High Intensity Discharge (HID) and incandescent
raceway	any channel designed for holding wires, cables, or busbars, and, unless otherwise qualified by rules of the CEC, the term includes conduit (rigid, flexible, metal, non-metallic) electrical, metallic and nonmetallic, underfloor raceway, cellular floors, surface raceways, wireways, cable trays, busways, and auxiliary gutters
seismic restraint system	a restraint or support system designed to prevent non-structural components from moving during an earthquake
specifications	an explicit set of requirements to be satisfied by a material, product or service including but not limited to local and national building codes, any documentation that holds legal obligations, schematics, manufacturers specs, local code, provincial/federal authority, engineered drawings and diagrams and schematics, customer requirements, warranty documents, site drawings, shop drawings, company requirements

voltage system, low	any voltage exceeding 30 but not exceeding 750
voltage system, high	any voltage exceeding 750 volts

APPENDIX C ACRONYMS

3D	three dimensional
AC	alternating current
CAT-6	category 6 cable
CDP	central distribution panel
CEC	Canadian Electrical Code
CSA	Canadian Standards Association
CT	current transformer
DC	direct current
DVR	digital video recorder
FLA	full load amp
GFCI	ground fault circuit interrupter
HID	high intensity discharge
HRC	high rupture capacity
HVAC	heating, ventilation and cooling
LEED	Leadership in Energy and Environmental Design
LED	light emitting diode
MCC	motor control center
MSDS	material safety data sheet
NBC	National Building Code
NFPA	National Fire Protection Association
OH&S	Occupational Health and Safety
PA	public address

PLC	programmable logic controller
PPE	personal protective equipment
PT	potential transformer
TDG	transportation of dangerous goods
UPS	uninterruptible power supply
VA	volt-amperes
VFD	variable frequency drive
WHMIS	Workplace Hazardous Materials Information System

APPENDIX D BLOCK AND TASK WEIGHTING

BLOCK A COMMON OCCUPATIONAL SKILLS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	12	12	10	14	25	12	15	10	15	15	NV	NV	NV	14%

Task 1 Performs safety-related functions.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	20	16	20	50	15	20	20	25	NV	NV	NV	23%

Task 2 Uses and maintains tools and equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	20	17	5	8	40	10	20	20	NV	NV	NV	18%

Task 3 Organizes work.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	20	23	20	17	15	30	27	10	NV	NV	NV	20%

Task 4 Fabricates and installs support components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	20	26	20	8	20	15	20	25	NV	NV	NV	19%

Task 5 Commissions and decommissions electrical systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	20	20	18	35	17	10	25	13	20	NV	NV	NV	20%

BLOCK B SYSTEMS, DISTRIBUTION AND SERVICES

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	25	25	20	23	25	24	25	25	25	20	NV	NV	NV	24%

Task 6 Installs service entrance and distribution equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	25	25	32	30	21	40	40	28	15	NV	NV	NV	29%

Task 7 Installs bonding, grounding and cathodic protection systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	25	18	22	20	42	25	20	32	25	NV	NV	NV	26%

Task 8 Installs power generation systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	15	15	15	20	12	10	15	16	15	NV	NV	NV	14%

Task 9 Installs high voltage systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	10	17	12	10	8	10	10	12	20	NV	NV	NV	12%

Task 10 Installs transformers.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	25	25	19	20	17	15	15	12	25	NV	NV	NV	19%

BLOCK C WIRING METHODS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	25	26	25	26	20	23	20	35	25	32	NV	NV	NV	25%

Task 11 Installs raceways and cables.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	30	25	34	30	43	40	30	32	40	NV	NV	NV	33%

Task 12 Installs branch circuitry.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	30	33	30	35	35	40	32	40	NV	NV	NV	36%

Task 13 Installs heating, ventilation and cooling (HVAC) systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	10	25	19	20	9	10	15	20	10	NV	NV	NV	16%

Task 14 Installs emergency lighting systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	10	20	20	14	20	13	15	15	16	10	NV	NV	NV	15%

BLOCK D MOTORS AND CONTROL SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	10	10	15	14	20	18	15	20	20	15	NV	NV	NV	16%

Task 15 Installs motor controls and protection.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	60	60	60	65	55	56	60	70	65	75	NV	NV	NV	63%

Task 16 Installs motors.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	40	40	40	35	45	44	40	30	35	25	NV	NV	NV	37%

BLOCK E SIGNALLING AND COMMUNICATION SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	13	15	15	9	5	11	5	5	10	10	NV	NV	NV	10%

Task 17 Installs signalling systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	50	30	30	32	45	45	33	60	40	50	NV	NV	NV	42%

Task 18 Installs communication systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	20	50	30	46	20	10	33	25	30	10	NV	NV	NV	27%

Task 19 Installs integrated control systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	20	40	22	35	45	34	15	30	40	NV	NV	NV	31%

BLOCK F UPGRADING, SERVICE AND MAINTENANCE

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	15	12	15	14	5	12	20	5	5	8	NV	NV	NV	11%

Task 20 Upgrades electrical systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	35	50	40	36	30	33	50	50	20	30	NV	NV	NV	37%

Task 21 Services electrical systems.

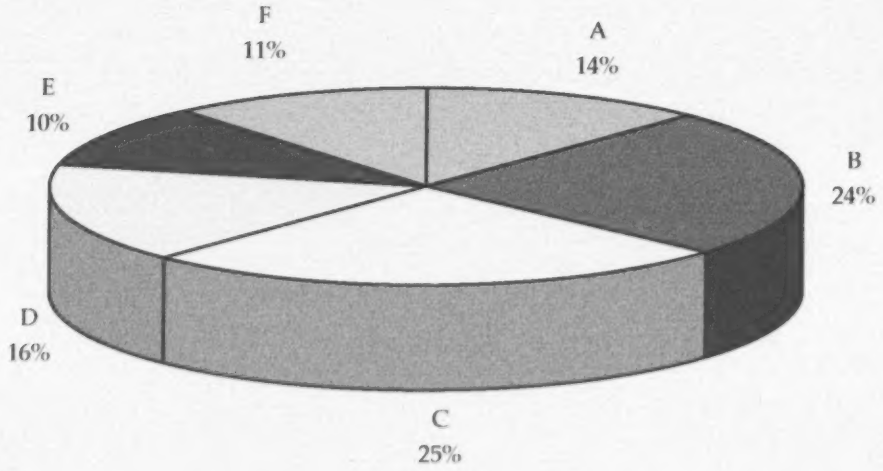
	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	35	30	30	36	40	33	25	30	40	50	NV	NV	NV	35%

Task 22 Maintains electrical systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	30	20	30	28	30	34	25	20	40	20	NV	NV	NV	28%

APPENDIX E

PIE CHART*



TITLES OF BLOCKS

BLOCK A	Common Occupational Skills	BLOCK D	Motors and Control Systems
BLOCK B	Systems, Distribution and Services	BLOCK E	Signalling and Communication Systems
BLOCK C	Wiring Methods	BLOCK F	Upgrading, Service and Maintenance

*Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

APPENDIX F

TASK PROFILE CHART — Construction Electrician

BLOCKS	TASKS	SUB-TASKS				
A - COMMON OCCUPATIONAL SKILLS	1. Performs safety-related functions.	1.01 Uses personal protective equipment (PPE) and safety equipment.	1.02 Maintains safe work environment.	1.03 Performs lock-out and tagging procedures.		
	2. Uses and maintains tools and equipment.	2.01 Maintains tools and equipment.	2.02 Uses access equipment.	2.03 Uses rigging, hoisting and lifting equipment.		
	3. Organizes work.	3.01 Interprets plans, drawings and specifications.	3.02 Organizes materials and supplies.	3.03 Plans project tasks and procedures.	3.04 Prepares work site.	3.05 Finalizes required documentation.
	4. Fabricates and installs support components.	4.01 Fabricates support structures.	4.02 Installs brackets, hangers and fasteners.	4.03 Installs seismic restraint systems.		
	5. Commissions and decommissions electrical systems.	5.01 Performs start-up and shut-down procedures.	5.02 Conducts operational tests.			
B - SYSTEMS, DISTRIBUTION AND SERVICES	6. Installs service entrance and distribution equipment.	6.01 Installs consumer/supply services.	6.02 Installs metering systems.	6.03 Installs overcurrent protection.	6.04 Installs power distribution centres.	6.05 Installs temporary power.
		6.06 Installs surge suppression systems.	6.07 Installs power conditioning systems.	6.08 Installs uninterruptible power supply (UPS) systems.	6.09 Installs panels and sub-panels.	

BLOCKS	TASKS	SUB-TASKS				
C - WIRING METHODS	7. Installs bonding, grounding and cathodic protection systems.	7.01 Installs grounding systems.	7.02 Installs bonding conductors.	7.03 Installs ground fault protection systems.	7.04 Installs lightning arresters.	7.05 Installs cathodic protection systems.
	8. Installs power generation systems.	8.01 Installs generators and transfer switches.	8.02 Installs alternative power systems.			
	9. Installs high voltage systems.	9.01 Installs high voltage equipment.	9.02 Installs high voltage cables.	9.03 Terminates high voltage cables.	9.04 Tests high voltage systems.	
	10. Installs transformers.	10.01 Installs extra low voltage transformers.	10.02 Installs low voltage transformers.	10.03 Installs high voltage transformers.		
	11. Installs raceways and cables.	11.01 Installs raceways.	11.02 Installs cables.	11.03 Installs underground cables and raceways.	11.04 Installs enclosures.	11.05 Installs conductors in raceways.
	12. Installs branch circuitry.	12.01 Installs luminaires.	12.02 Installs wiring devices.	12.03 Installs lighting controls.	12.04 Installs light posts.	12.05 Installs branch circuit protection.
	13. Installs heating, ventilation and cooling (HVAC) systems.	13.01 Installs electric heating systems.	13.02 Connects HVAC systems.	13.03 Installs HVAC control systems.		
	14. Installs emergency lighting systems.	14.01 Installs exit lighting.	14.02 Installs battery-operated lighting.			

BLOCKS	TASKS	SUB-TASKS				
D - MOTORS AND CONTROL SYSTEMS	15. Installs motor controls and protection.	15.01 Installs starters.	15.02 Installs variable frequency drives (VFD).	15.03 Installs overload protection.	15.04 Installs automated control systems.	15.05 Installs motor overcurrent protection.
	16. Installs motors.	16.01 Installs alternating current (AC) motors.	16.02 Installs direct current (DC) motors.			
E - SIGNALLING AND COMMUNICATION SYSTEMS	17. Installs signalling systems.	17.01 Installs fire alarm systems.	17.02 Installs nurse call systems.	17.03 Installs security and surveillance systems.		
	18. Installs communication systems.	18.01 Installs voice/data systems.	18.02 Installs public address (PA) systems.	18.03 Installs community antenna distribution, and radio and television systems.		
	19. Installs integrated control systems.	19.01 Installs building automation systems.	19.02 Installs building control systems.			
F - UPGRADING, SERVICE AND MAINTENANCE	20. Upgrades electrical systems.	20.01 Evaluates existing electrical systems.	20.02 Replaces electrical systems and equipment.			
	21. Services electrical systems.	21.01 Diagnoses electrical systems.	21.02 Repairs electrical components.			
	22. Maintains electrical systems.	22.01 Implements maintenance schedule.	22.02 Tests system operation.	22.03 Maintains electrical components.		